Exercise - I (Conceptual Questions) Build Up Your Understanding

PHOTO ELECTRIC EFFECT

1. The energy of photon of visible light with maximum wavelength in eV is :
(1) 1 (2) 1.6 (3) 3.2 (4) 7

2. What is the momentum of a photon having frequency 1.5×10^{13} Hz :
(1) 3.3×10^{-29} kg m/s (2) 3.3×10^{-34} kg m/s
(3) 6.6×10^{-34} kg m/s (4) 6.6×10^{-30} kg m/s

3. The strength of photoelectric current is directly proportional to :
(1) Frequency of incident radiation
(2) Intensity of incident radiation
(3) Angle of incidence of radiation
(4) Distance between anode and cathode

4. When light is incident on surface, photo electrons are emitted. For photoelectrons :
(1) The value of kinetic energy is same for all
(2) Maximum kinetic energy do not depend on the wave length of incident light
(3) The value of kinetic energy is equal to or less than a maximum kinetic energy
(4) None of the above.

5. When light falls on a photosensitive surface, electrons are emitted from the surface. The kinetic energy of these electrons does not depend on the:
(1) Wavelength of light
(2) Frequency of light
(3) Type of material used for the surface
(4) Intensity of light

6. The work- function of a substance is 4.0 eV. The longest wavelength of light that can cause photoelectron emission from this substance is approximately :
(1) 540 nm (2) 400 nm
(3) 310 nm (4) 220 nm

7. Photoelectric effect takes place in element A. Its work function is 2.5 eV and threshold wavelength is λ. An other element B is having work function of 5 eV. Then find out the maximum wavelength that can produce photoelectric effect in B :
(1) $\lambda/2$ (2) 2λ (3) λ (4) 3λ

8. When light of wavelength lesser than 6000 Å is incident on a metal, electrons are emitted. The approximate work-function of the metal is:
(1) 1 eV (2) 2 eV (3) 4 eV (4) 6 eV

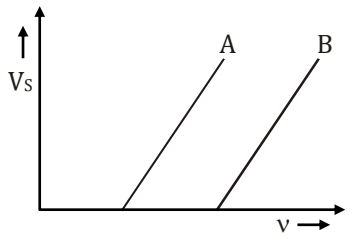
9. Surface of sodium is illuminated by a light of 6000 Å wavelength. Work function of sodium is 1.6 eV. Then minimum K.E. of emitted electrons is :
(1) 0 eV (2) 1.53 eV
(3) 2.46 eV (4) 4.14 eV

10. The maximum kinetic energy of photoelectrons emitted from a surface when photons of energy 6 eV fall on it is 4 eV. The stopping potential in volt is :
(1) 4 (2) 6 (3) 8 (4) 10

11. When a point source of monochromatic light is at a distance of 0.2 m from a photoelectric cell, the cut - off voltage and the saturation current are 0.6 volt and 18 mA respectively. If the same source is placed 0.6 m away from the photoelectric cell, then :-
(1) The stopping potential will be 0.2 V
(2) The stopping potential will be 0.6 V
(3) The saturation current will be 6 mA
(4) The saturation current will be 18 mA

12. The maximum wavelength of light for photoelectric effect from a metal is 200 nm. The maximum kinetic energy of electron which is emitted by the radiation of wavelength 100 nm will be :
(1) 12.4 eV (2) 6.2 eV
(3) 100 eV (4) 200 eV

13. The stopping potential as a function of frequency of incident radiation is plotted for two different surfaces A and B. The graphs show that the work function of A is



(1) Greater than that of B
(2) Smaller than that of B
(3) Same as that of B
(4) No comparison can be done from given graphs

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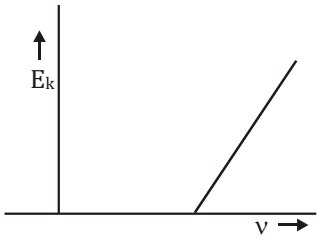
14. The slope of graph drawn between stopping potential and frequency of incident light for a given surface will be :-
(1) h (2) h/e (3) eh (4) e

15. By photo electric effect, Einstein proved :-
(1) $E = h\nu$ (2) $KE = \frac{1}{2} mv^2$
(3) $E = mc^2$ (4) $E = \frac{-Rhc^2}{n^2}$

16. Which one among shows particle nature of light?
(1) P.E.E. (2) Interference
(3) Refraction (4) Polarization

17. A photo-cell is illuminated by a source of light, which is placed at a distance d from the cell, If the distance become d/2, then number of electrons emitted per second will be :-
(1) Remain same (2) Four times
(3) Two times (4) One-fourth

18. Graph is plotted between maximum kinetic energy of electron with frequency of incident photon in Photo electric effect. The slope of curve will be :



(1) Charge of electron
(2) Work function of metal
(3) Planck's constant
(4) Ratio of Planck constant and charge of electron

19. Photon of energy 6 eV is incident on a metal surface of work function 4 eV. Maximum KE of emitted photo electrons will be :-
(1) 0 eV (2) 1 eV (3) 2 eV (4) 10 eV

20. Light of frequency ν is incident on a metal of threshold frequency ν_0. Then work function of metal will be:-
(1) $h\nu$ (2) $h\nu_0$
(3) $h(\nu - \nu_0)$ (4) $h(\nu + \nu_0)$

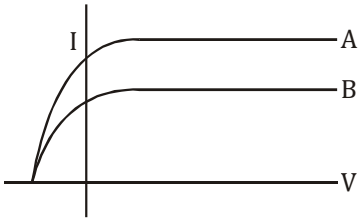
21. The work function of a photo electric material is 3.3 eV. Its threshold frequency will be :
(1) 4×10^{23} Hz (2) 8×10^{12} Hz
(3) 4×10^{11} Hz (4) 8×10^{14} Hz

22. The value of planck's constant is :–
(1) 6.63×10^{-34} J/s
(2) 6.63×10^{-34} kg–m^2/s
(3) 6.63×10^{-34} kg–m^2
(4) 6.63×10^{-34} J–s^{-1}

23. When ultraviolet rays incident on metal plate then photoelectric effect does not occur, it occurs by incidence of :–
(1) Infrared rays (2) X–rays
(3) Radio wave (4) Light wave

24. A photoelectric cell is illuminated by a point source of light 1 m away. When the source is shifted to 2m then
(1) each emitted electron carries one quarter of the initial energy
(2) number of electrons emitted is half the initial number
(3) each emitted electron carries half the initial energy
(4) number of electrons emitted is a quarter of the initial number

25. The graphs show the variation of current I (y-axis) in two photocell A & B as a function of the applied voltage V(x-axis) when light of same frequency is incident on the cell. Which of the following is the correct conclusion drawn from the data ?



(1) Cathodes of the two cells are made from the same substance, the intensity of light used are different
(2) Cathodes are made from different substances and the intensity of light is the same
(3) Cathode substances as well as intensity of light are different
(4) no conclusion can be drawn

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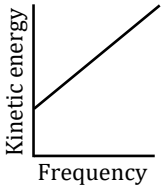
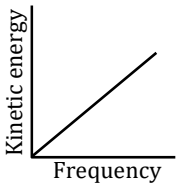
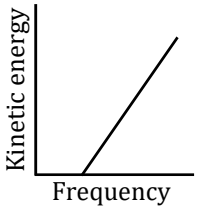
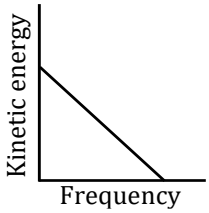
26. According to Einstein's photoelectric equation, the graph between the kinetic energy of photoelectrons ejected and the frequency of incident radiation is

(1) 

(2) 

(3) 

(4) 

27. According to Einstein's photoelectric equation, the plot of the kinetic energy of the emitted photoelectrons from a metal v/s the frequency of the incident radiation gives a straight line whose slope :

(1) depends on the intensity of the radiation
(2) depends of the nature of the metal used
(3) depends both on the intensity of the radiation and the metal used.
(4) is the same for all metals and independent of the intensity of the radiation.

28. A photon of energy 4 eV is incident on a metal surface whose work function is 2eV. The minimum reverse potential to be applied for stopping the current is :-

(1) 2V (2) 4V (3) 6V (4) 8V

MATTER WAVES

29. If E and P are the energy and the momentum of a photon respectively then on reducing the wavelength of photon -

(1) P and E both will decrease
(2) P and E both will increase
(3) P will increase and E will decrease
(4) P will decrease and E will increase

30. If the kinetic energy of a moving particle is E, then the De Broglie wavelength is :

(1) $h\sqrt{2mE}$ (2) $\sqrt{\frac{2mE}{h}}$

(3) $\frac{h}{\sqrt{2mE}}$ (4) $\frac{hE}{\sqrt{2mE}}$

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31. Electron has energy of 100 eV what will be its wavelength :

(1) 1.2 Å (2) 10 Å
(3) 100 Å (4) 1 Å

32. The ratio of wavelength of deutron and proton accelerated through the same potential difference will be -

(1) $\frac{1}{\sqrt{2}}$ (2) $\sqrt{\frac{2}{1}}$ (3) $\frac{1}{2}$ (4) $\frac{2}{1}$

33. An electron is accelerated from rest, between two points A and B at which the potentials are 20V and 40 V respectively. The De Broglie wavelength associated with the electron at B will be -

(1) 0.75 Å (2) 7.5 Å
(3) 2.75 Å (4) 2.75 m

34. An electron is moving with velocity 6.6×10^3 m/s. The De-Broglie wavelength associated with electron is (mass of electron = 9×10^{-31} Kg, Plank's Constant = 6.62×10^{-34} J-S)

(1) 1×10^{-19} m (2) 1×10^{-5} m
(3) 1×10^{-7} m (4) 1×10^{-10} m

35. The energy that should be added to an electron to reduce its De-Broglie wavelength from 10^{-10}m to 0.5×10^{-10} m will be :

(1) Four times the initial energy
(2) Equal to initial energy
(3) Twice the initial energy
(4) Thrice the initial energy

36. The magnitude of De broglie wavelength (λ) of electron (e), proton (p), neutron (n) and α - particle (α) all having the same kinetic energy of 1MeV, in the increasing order will follow the sequence :

(1) $\lambda_e, \lambda_p, \lambda_n, \lambda_\alpha$ (2) $\lambda_e, \lambda_n, \lambda_p, \lambda_\alpha$
(3) $\lambda_\alpha, \lambda_n, \lambda_p, \lambda_e$ (4) $\lambda_p, \lambda_e, \lambda_\alpha, \lambda_n$

37. The accelerating voltage of an electron gun is 50,000 volt. De-Broglie wavelength of the electron will be :

(1) 0.55 Å (2) 0.055 Å
(3) 0.077Å (4) 0.095 Å

38. If the mass of neutron = 1.7×10^{-27} kg. then the De broglie wavelength of neutron of energy 3eV is :

(1) 1.6×10^{-10} m (2) 1.6×10^{-11} m
(3) 1.4×10^{-10} m (4) 1.4×10^{-11} m

39. A proton and an α-particle accelerated through same voltage. The ratio of their De-broglie wavelength will be :
(1) 1 : 2 (2) $2\sqrt{2}:1$ (3) $\sqrt{2}:1$ (4) 2 : 1

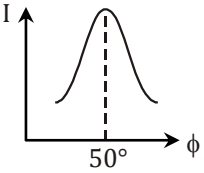
40. The De Broglie wavelength of an atom at absolute temperature T K will be -
(1) $\frac{h}{mKT}$ (2) $\frac{h}{\sqrt{3mKT}}$
(3) $\frac{\sqrt{3mKT}}{h}$ (4) $\sqrt{3mKT}$

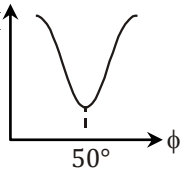
41. The De-Broglie wavelength associated with electrons revolving round the nucleus in a hydrogen atom in ground state, will be-
(1) 0.3 Å (2) 3.3 Å (3) 6.62 Å (4) 10 Å

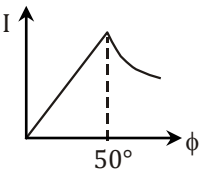
42. The wavelength of very fast moving electron ($v \approx c$) is :
(1) $\lambda = \frac{h}{m_0 v}$ (2) $\lambda = \frac{h}{\sqrt{2mE}}$
(3) $\lambda^2 = \frac{h^2}{\sqrt{2mE}}$ (4) $\lambda = \frac{h\sqrt{1-\frac{v^2}{c^2}}}{m_0 v}$

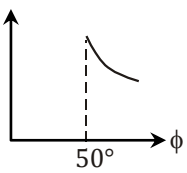
43. Which experiment explains the wave nature of electron :-
(1) Michelson's experiment
(2) Davisson Germer experiment
(3) Roentgen experiment
(4) Rutherford experiment

44. In davisson-Germer experiment, the filament emits :-
(1) Photons (2) Protons
(3) X - rays (4) Electrons

45. The correct curve between intensity of scattering (I) and the angle of diffraction ϕ in Davisson - Germer experiment is :
(1) 

(2) 

(3) 

(4) 

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46. In Davisson - Germer experiment, Nickel crystal acts as :-
(1) Perfect reflector
(2) Three dimensional diffraction grating
(3) Ideal absorber
(4) Two dimensional diffraction grating

47. The diffracted waves in the Davisson-Germer experiment are :-
(1) Electrons (2) X - Rays
(3) Photons (4) Protons

48. An electron and a proton have the same De-Broglie wavelength. Then the kinetic energy of the electron is :
(1) zero
(2) Infinity
(3) Equal to kinetic energy of proton
(4) Greater than the kinetic energy of proton

49. De Broglie equation for an electron shows is :
(1) Particle nature (2) Wave nature
(3) Dual nature (4) None of these

50. What will happen to De Broglie's wavelength if the velocity of electron is increased :
(1) It will increase
(2) It will decrease
(3) It will remain same
(4) It will become twice

51. A photon of wavelength 4400Å is passing through vaccum. The effective mass and momentum of the photon are respectively
(1) 5×10^{-36} kg, 1.5×10^{-27} kg – m/s
(2) 5×10^{-35} kg, 1.5×10^{-26} kg – m/s
(3) zero, 1.5×10^{-26} kg – m/s
(4) 5×10^{-36} kg, 1.67×10^{-43} kg – m/s

52. Which of the following is true for photon :-
(1) $E = \frac{hc}{\lambda}$ (2) $E = \frac{1}{2}mv^2$
(3) $P = \frac{E}{2V}$ (4) $E = \frac{1}{2}mc^2$

53. For a moving particle having kinetic energy E, the correct de Broglie wavelength is :
(1) It is not applicable for a particle
(2) $\frac{h}{\sqrt{2mE}}$
(3) $E\sqrt{\frac{h}{2m}}$
(4) $\frac{h}{2mE}$

54. The De Broglie wavelength of an electron in the first bohr orbit is :
(1) Equal to the circumference of the first orbit
(2) Equal to twice the circumference of the first orbit
(3) Equal to half the circumference of the first orbit
(4) Equal to one fourth the circumference of first orbit

55. If given particles are moving with same velocity, then maximum de-Broglie wavelength for :
(1) Proton (2) α - particle
(3) Neutron (4) β - particle

56. A proton is about 1840 times heavier than an electron. When it is accelerated by a potential difference of 1 kV, its kinetic energy will be :–
(1) 1840 keV. (2) 1/1840 keV.
(3) 1 keV. (4) 920 keV.

57. If an electron and a photon propagate with same wavelength, it implies that they can have the same:–
(1) Energy
(2) Momentum
(3) Velocity
(4) Angular momentum

58. According to De Broglie, wavelength of electron in second orbit is 10^{-9} metre. Then the circumference of orbit is :–
(1) 10^{-9} m (2) 2×10^{-9} m
(3) 3×10^{-9} m (4) 4×10^{-9}m

59. If the mass of a microscopic particle as well as its speed are halved, the de Broglie wavelength associated with the particle will
(1) increased by a factor more than 2
(2) increase by a factor of 2
(3) decrease by a factor of 2
(4) decrease by a factor more than 2

60. An electron and proton are accelerated through same potential, then λ_e/λ_p will be
(1) 1 (2) m_e/m_p
(3) m_p/m_e (4) $\sqrt{m_p/m_e}$

61. An electron, proton and alpha particle have same kinetic energy. The corresponding de-Broglie wavelength would have the following relationship
(1) $\lambda_e > \lambda_p > \lambda_\alpha$ (2) $\lambda_p > \lambda_e > \lambda_\alpha$
(3) $\lambda_\alpha > \lambda_e > \lambda_p$ (4) $\lambda_\alpha > \lambda_p > \lambda_e$

62. What is the de Broglie wavelength of an electron with a kinetic energy of 120 eV ?
(Given : $h = 6.63 \times 10^{-34}$ J s, $m_e = 9.11 \times 10^{-31}$kg and $e = 1.6 \times 10^{-19}$ coulomb)
(1) 725 pm (2) 500 pm
(3) 322 pm (4) 112 pm

63. If λ_p and λ_α be the wavelengths of protons and α-particles of equal kinetic energies, then
(1) $\lambda_p = \frac{\lambda_\alpha}{4}$ (2) $\lambda_p = \frac{\lambda_\alpha}{2}$
(3) $\lambda_p = \lambda_\alpha$ (4) $\lambda_p = 2\lambda_\alpha$

EXERCISE-I (Conceptual Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	2	1	2	3	4	3	1	2	1	1	2	2	2	2	1
Question	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Answer	1	2	3	3	2	4	2	2	4	1	3	4	1	2	3
Question	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Answer	1	1	3	3	4	3	2	2	2	2	2	4	2	4	1
Question	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Answer	2	1	4	3	2	1	1	2	1	4	3	2	2	1	4
Question	61	62	63												
Answer	1	4	4												

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Exercise - II (Previous Year Questions) AIPMT/NEET

AIPMT 2006

1. A photo-cell employs photoelectric effect to convert
(1) Change in the frequency of light into a change in electric voltage
(2) Change in the intensity of illumination into a change in photoelectric current
(3) Change in the intensity of illumination into a change in the work function of the photocathode
(4) Change in the frequency of light into a change in the electric current

2. When photons of energy $h\nu$ fall on an aluminium plate (of work function E_0), photoelectrons on maximum kinetic energy K are ejected. If the frequency of the radiation is doubled, the maximum kinetic energy of the ejected photoelectrons will be:-
(1) $K + E_0$ (2) $2K$
(3) K (4) $K + h\nu$

3. The momentum of a photon of energy 1MeV in kg m/s, will be :-
(1) 0.33×10^{6} (2) 7×10^{-24}
(3) 10^{-22} (4) 5×10^{-22}

AIPMT 2007

4. A 5 watt source emits monochromatic light of wavelength 5000 Å. When placed 0.5 m away, it liberates photoelectrons from a photosensitive metallic surface. When the source is moved to a distance of 1.0 m, the number of photo electrons liberated will :
(1) be reduced by a factor of 2
(2) be reduced by a factor of 4
(3) be reduced by a factor of 8
(4) be reduced by a factor of 16

5. Monochromatic light of frequency 6.0×10^{14} Hz is produced by a laser. The power emitted is 2×10^{-3} W. The number of photons emitted, on the average, by the source per second is :
(1) 5×10^{14} (2) 5×10^{15}
(3) 5×10^{16} (4) 5×10^{17}

AIPMT 2008

6. The work function of a surface of a photosensitive material is 6.2 eV. The wavelength of the incident radiation for which the stopping potential is 5V lies in the :-
(1) Infrared region (2) X-ray region
(3) Ultraviolet region (4) Visible region

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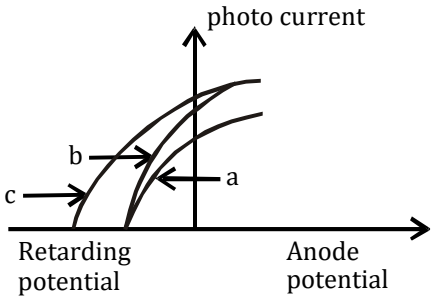
AIPMT 2009

7. The number of photo electrons emitted for light of a frequency ν (higher than the threshold frequency ν_0) is proportional to :-
(1) Frequency of light (ν)
(2) $\nu - \nu_0$
(3) Threshold frequency (ν_0)
(4) Intensity of light

8. Monochromatic light of wavelength 667 nm is produced by a helium neon laser. The power emitted is 9 mW. The number of photons arriving per sec. on the average at a target irradiated by this beam is :-
(1) 3×10^{19} (2) 9×10^{17}
(3) 3×10^{16} (4) 9×10^{15}

9. The figure shows a plot of photo current versus anode potential for a photo sensitive surface for three different radiations. Which one of the following is a correct statement ?



(1) curves (b) and (c) represent incident radiations of same frequency having same intensity
(2) curves (a) and (b) represent incident radiations of different frequencies and different intensities
(3) curves (a) and (b) represent incident radiations of same frequency but of different intensities
(4) curves (b) and (c) represent incident radiations of different frequencies and different intensities

AIPMT (Pre) 2010

10. A source S_1 is producing, 10^{15} photons per second of wavelength 5000 Å. Another source S_2 is producing 1.02×10^{15} photons per second of wavelength 5100 Å.
Then, (power of S_2)/(power of S_1) is equal to :-
(1) 0.98 (2) 1.00 (3) 1.02 (4) 1.04

11. The potential difference that must be applied to stop the fastest photo electrons emitted by a nickel surface, having work function 5.01 eV, when ultraviolet light of 200 nm falls on it, must be -
(1) 1.2 V (2) 2.4 V
(3) –1.2 V (4) –2.4V

AIPMT (Mains) 2010

12. The electron in the hydrogen atom jumps from excited state (n = 3) to its ground state (n = 1) and the photons thus emitted irradiate a photosensitive material. If the work function of the material is 5.1 eV, the stopping potential is estimated to be (the energy of the electron in n^{th} state):-
(1) 12.1 V (2) 17.2 V (3) 7 V (4) 5.1 V

AIPMT (Pre) 2011

13. Photoelectric emission occurs only when the incident light has more than a certain minimum:-
(1) Power (2) Wavelength
(3) Intensity (4) Frequency

14. Light of two different frequencies whose photons have energies 1 eV and 2.5 eV respectively illuminate a metallic surface whose work function is 0.5 eV successively. Ratio of maximum speed of emitted electrons will be :
(1) 1 : 4 (2) 1 : 2 (3) 1 : 1 (4) 1 : 5

15. In photoelectric emission process from a metal of work function 1.8eV, the kinetic energy of most energetic electrons is 0.5 eV. The corresponding stopping potential is :
(1) 1.8 V (2) 1.3V (3) 0.5V (4) 2.3V

16. A radioactive nucleus of mass M emits a photon of frequency ν and the nucleus recoils. The recoil energy will be :-
(1) $Mc^2 - h\nu$ (2) $h^2\nu^2 / 2Mc^2$
(3) Zero (4) $h\nu$

17. In the Davisson and Germer experiment, the velocity of electrons emitted from the electron gun can be increased by :
(1) increasing the potential difference between the anode and filament
(2) increasing the filament current
(3) decreasing the filament current
(4) decreasing the potential difference between the anode and filament

18. Electrons used in an electron microscope are accelerated by a voltage of 25 kV. If the voltage is increased to 100 kV then the de-Broglie wavelength associated with the electrons would :
(1) increase by 2 times
(2) decrease by 2 times
(3) decrease by 4 times
(4) increase by 4 times

AIPMT (Mains) 2011

19. The threshold frequency for a photosensitive metal is 3.3×10^{14} Hz. If light of frequency 8.2×10^{14} Hz is incident on this metal, the cut-off voltage for the photoelectric emission is nearly :-
(1) 1 V (2) 2 V (3) 3 V (4) 5 V

20. An electron in the hydrogen atom jumps from excited state n to the ground state. The wavelength so emitted illuminates a photosensitive material having work function 2.75 eV. If the stopping potential of the photoelectron is 10 V, then the value of n is :-
(1) 2 (2) 3 (3) 4 (4) 5

AIPMT (Pre) 2012

21. Monochromatic radiation emitted when electron on hydrogen atom jumps from first excited to the grounds state irradiates a photosensitive material. The stopping potential is measured to be 3.57V. The threshold frequency of the material is :
(1) 1.6×10^{15} Hz (2) 2.5×10^{15} Hz
(3) 4×10^{15} Hz (4) 5×10^{15} Hz

22. A 200W sodium street lamp emits yellow light of wavelength 0.6 μm. Assuming it to be 25% efficient converting electrical energy to light, the number of photons of yellow light it emits per second is :-
(1) 62×10^{20} (2) 3×10^{19}
(3) 1.5×10^{20} (4) 6×10^{18}

23. An α-particle moves in a circular path of radius 0.83 cm in the presence of a magnetic field of 0.25 Wb/m^2. The de Broglie wavelength associated with the particle will be :
(1) 10Å (2) 0.1Å
(3) 1Å (4) 0.01Å

TG: @Chalnaayaaar

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24. An electron of stationary hydrogen atom passes from the fifth energy level to the ground level. The velocity that the atom acquired a result of photon emission will be :

(1) $\frac{25m}{24hR}$ (2) $\frac{24m}{25hR}$ (3) $\frac{24hR}{25m}$ (4) $\frac{25hR}{24m}$

(m is the mass of the atom, R, Rydberg constant and h Planck's constant)

AIPMT (Mains) 2012

25. If the momentum of an electron is changed by P, then the de Broglie wavelength associated with it changes by 0.5%. The initial momentum of electron will be :-

(1) $\frac{P}{200}$ (2) 100 P (3) 200 P (4)400 P

NEET-UG 2013

26. For photoelectric emission from certain metal the cut off frequency is ν. If radiation of frequency 2ν impinges on the metal plate, the maximum possible velocity of the emitted electron will be (m is the electron mass) :-

(1) $2\sqrt{h\nu/m}$ (2) $\sqrt{h\nu/(2m)}$

(3) $\sqrt{h\nu/m}$ (4) $\sqrt{2h\nu/m}$

27. The wavelength λ_e of an electron and λ_P of a photon of same energy E are related by:

(1) $\lambda_P \propto \frac{1}{\sqrt{\lambda_e}}$ (2) $\lambda_P \propto \lambda_e^2$

(3) $\lambda_P \propto \lambda_e$ (4) $\lambda_P \propto \sqrt{\lambda_e}$

AIPMT 2014

28. Light with an energy flux of 25×10^4 Wm^{-2} falls on a perfectly reflecting surface at normal incidence. If the surface area is 15 cm^2, the average force exerted on the surface is :-

(1) 1.25×10^{-6} N (2) 2.50×10^{-6} N

(3) 1.20×10^{-6} N (4) 3.0×10^{-6} N

29. When the energy of the incident radiation is increased by 20%, the kinetic energy of the photoelectrons emitted from a metal surface increased from 0.5 eV to 0.8 eV. The work function of the metal is :-

(1) 0.65 eV (2) 1.0 eV

(3) 1.3 eV (4) 1.5 eV

TG: @Chalnaayaaar

30. If the kinetic energy of the particle is increased to 16 times its previous value, the percentage change in the de-Broglie wavelength of the particle is :-

(1) 25 (2) 75 (3) 60 (4) 50

AIPMT 2015

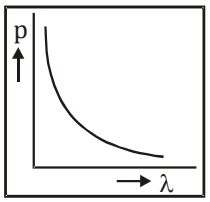
31. A certain metallic surface is illuminated with monochromatic light of wavelength, λ. The stopping potential for photo-electric current for this light is $3V_0$. if the same surface is illuminated with light of wavelength 2λ, the stopping potential is V_0. The threshold wavelength for this surface for photoelectric effect is :-

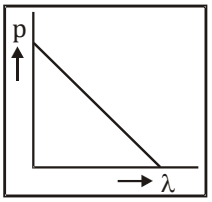
(1) 4 λ (2) $\frac{\lambda}{4}$ (3) $\frac{\lambda}{6}$ (4) 6 λ

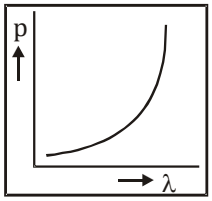
32. A radiation of energy 'E' falls normally on a perfectly reflecting surface. The momentum transferred to the surface is (C=Velocity of light):-

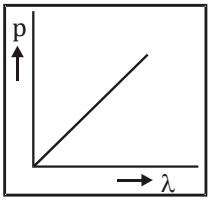
(1) $\frac{2E}{C}$ (2) $\frac{2E}{C^2}$ (3) $\frac{E}{C^2}$ (4) $\frac{E}{C}$

33. Which of the following figures represent the variation of particle momentum and the associated de-Broglie wavelength ?

(1) 

(2) 

(3) 

(4) 

RE-AIPMT 2015

34. Light of wavelength 500 nm is incident on a metal with work function 2.28 eV. The de Broglie wavelength of the emitted electron is :-

(1) $\leq 2.8 \times 10^{-12}$m (2) $< 2.8 \times 10^{-10}$m

(3) $< 2.8 \times 10^{-9}$ m (4) $\geq 2.8 \times 10^{-9}$ m

35. A photoelectric surface is illuminated successively by monochromatic light of wavelength λ and $\lambda/2$. If the maximum kinetic energy of the emitted photoelectrons in the second case is 3 times that in the first case, the work function of the surface of the material is: (h = Plank's constant, c = speed of light)

(1) $\frac{hc}{3\lambda}$ (2) $\frac{hc}{2\lambda}$ (3) $\frac{hc}{\lambda}$ (4) $\frac{2hc}{\lambda}$

NEET-I 2016

36. An electron of mass m and a photon have same energy E. The ratio of de-Broglie wavelengths associated with them is :

(1) $\frac{1}{c}\left(\frac{E}{2m}\right)^{\frac{1}{2}}$ (2) $\left(\frac{E}{2m}\right)^{\frac{1}{2}}$

(3) $c(2mE)^{\frac{1}{2}}$ (4) $\frac{1}{xc}\left(\frac{2m}{E}\right)^{\frac{1}{2}}$

37. When a metallic surface is illuminated with radiation of wavelength λ, the stopping potential is V. If the same surface is illuminated with radiation of wavelength 2λ, the stopping potential is $\frac{V}{4}$. The threshold wavelength for the metallic surface is :-

(1) 4λ (2) 5λ (3) $\frac{5}{2}\lambda$ (4) 3λ

NEET-II 2016

38. Photons with energy 5 eV are incident on a cathode C in a photoelectric cell. The maximum energy of emitted photoelectrons is 2 eV. When photons of energy 6 eV are incident on C, no photoelectrons will reach the anode A, if the stopping potential of A relative to C is :-

(1) – 1 V (2) – 3 V (3) + 3 V (4) + 4 V

NEET(UG) 2017

39. The de-Broglie wavelength of a neutron in thermal equilibrium with heavy water at a temperature T (Kelvin) and mass m, is :-

(1) $\frac{h}{\sqrt{3mkT}}$ (2) $\frac{2h}{\sqrt{3mkT}}$

(3) $\frac{2h}{\sqrt{mkT}}$ (4) $\frac{2h}{\sqrt{mkT}}$

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40. The photoelectric threshold wavelength of silver is 3250×10^{-10}m. The velocity of the electron ejected from a silver surface by ultraviolet light of wavelength 2536×10^{-10} m is :-

(Given h = 4.14×10^{-15} eVs and c = 3×10^{8} ms^{-1})

(1) $\approx 0.6 \times 10^{4}$ ms^{-1} (2) $\approx 61 \times 10^{3}$ ms^{-1}

(3) $\approx 0.3 \times 10^{6}$ ms^{-1} (4) $\approx 6 \times 10^{5}$ ms^{-1}

NEET(UG) 2018

41. An electron of mass m with an initial velocity $\vec{V} = V_0\hat{i}(V_0 > 0)$ enters an electric field $\vec{E} = -E_0\hat{i}$ (E_0 = constant >0) at t = 0. If λ_0 is its de-Broglie wavelength initially, then its de-Broglie wavelength at time t is :-

(1) $\frac{\lambda_0}{\left(1+\frac{eE_0}{mV_0}t\right)}$ (2) $\lambda_0\left(1+\frac{eE_0}{mV_0}y\right)$

(3) $\lambda_0 t$ (4) λ_0

42. When the light of frequency $2\nu_0$ (where ν_0 is threshold frequency), is incident on a metal plate, the maximum velocity of electrons emitted is v_1. When the frequency of the incident radiation is increased to $5\nu_0$, the maximum velocity of electrons emitted from the same plate is v_2. The ratio of v_1 to v_2 is :-

(1) 1 : 2 (2) 1 : 4 (3) 4 : 1 (4) 2 : 1

NEET(UG) 2019

43. An electron is accelerated through a potential difference of 10,000 V. Its de Broglie wavelength is, (nearly): ($m_e = 9 \times 10^{-31}$ kg)

(1) 12.2×10^{-13} m (2) 12.2×10^{-12} m

(3) 12.2×10^{-14} m (4) 12.2 nm

NEET(UG) 2019 (Odisha)

44. The work function of a photosensitive material is 4.0 eV. The longest wavelength of light that can cause photon emission from the substance is (approximately)

(1) 3100 nm (2) 966 nm

(3) 31 nm (4) 310 nm

45. A proton and an α-particle are accelerated from rest to the same energy. The de Broglie wavelengths λ_p and λ_α are in the ratio,

(1) 2 : 1 (2) 1 : 1 (3) $\sqrt{2}$: 1 (4) 4 : 1

TG: @Chalnaayaar

NEET(UG) 2020

46. Light with an average flux of 20 W/cm^2 falls on a non-reflecting surface at normal incidence having surface area 20 cm^2. The energy received by the surface during time span of 1 minute is :
(1) 48×10^3 J (2) 10×10^3 J
(3) 12×10^3 J (4) 24×10^3 J

47. The energy required to break one bond in DNA is 10^{-20} J. This value in eV is nearly :
(1) 0.006 (2) 6 (3) 0.6 (4) 0.06

48. An electron is accelerated from rest through a potential difference of V volt. If the de Broglie wavelength of the electron is 1.227×10^{-2} nm, the potential difference is :
(1) 10^4 V (2) 10 V (3) 10^2 V (4) 10^3 V

49. Light of frequency 1.5 times the threshold frequency is incident on a photosensitive material. What will be the photoelectric current if the frequency is halved and intensity is doubled ?
(1) zero (2) doubled
(3) four times (4) one-fourth

NEET(UG) 2020 (COVID-19)

50. The de Broglie wavelength of an electron moving with kinetic energy of 144 eV is nearly
(1) $10^2 \times 10^{-3}$ nm (2) $10^2 \times 10^{-4}$ nm
(3) $10^2 \times 10^{-5}$ nm (4) $10^2 \times 10^{-2}$ nm

51. The wave nature of electrons was experimentally verified by,
(1) de Broglie
(2) Hertz
(3) Einstein
(4) Davisson & Germer

NEET(UG) 2021

52. The number of photons per second on an average emitted by the source of monochromatic light of wavelength 600 nm, when it delivers the power of 3.3×10^{-3} watt will be : ($h = 6.6 \times 10^{-34}$ Js)
(1) 10^{18} (2) 10^{17} (3) 10^{16} (4) 10^{15}

53. An electromagnetic wave of wavelength 'λ' is incident on a photosensitive surface of negligible work function. If 'm' mass is of photoelectron emitted from the surface has de-Broglie wavelength λ_d, then :
(1) $\lambda = \left(\frac{2m}{hc}\right)\lambda_d^2$ (2) $\lambda_d = \left(\frac{2mc}{h}\right)\lambda^2$
(3) $\lambda = \left(\frac{2mc}{h}\right)\lambda_d^2$ (4) $\lambda = \left(\frac{2h}{mc}\right)\lambda_d^2$

NEET(UG) 2022

54. When two monochromatic lights of frequency, ν and $\frac{\nu}{2}$ are incident on a photoelectric metal, their stopping potential becomes $\frac{V_s}{2}$ and V_s respectively. The threshold frequency for this metal is:
(1) 3ν (2) $\frac{2}{3}\nu$ (3) $\frac{3}{2}\nu$ (4) 2ν

RE-NEET(UG) 2022

55. The light rays having photons of energy 4.2 eV are falling on a metal surface having a work function of 2.2 eV. The stopping potential of the surface is :
(1) 2 eV (2) 2 V (3) 1.1 V (4) 6.4 V

56. The threshold frequency of a photoelectric metal is ν_0. If light of frequency $4\nu_0$ is incident on this metal, then the maximum kinetic energy of emitted electrons will be :
(1) $h\nu_0$ (2) $2\ h\nu_0$ (3) $3\ h\nu_0$ (4) $4\ h\nu_0$

EXERCISE-II (Previous Year Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	2	4	4	2	2	3	4	3	3	2	1	3	4	2	3
Question	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Answer	2	1	2	2	3	1	3	4	3	3	4	2	2	2	2
Question	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Answer	1	1	1	4	2	1	4	2	1	4	1	1	2	4	1
Question	46	47	48	49	50	51	52	53	54	55	56				
Answer	4	4	1	1	1	4	3	3	Bonus	2	3				

TG: @Chalnaayaar

Exercise - III (Analytical Questions) Master Your Understanding

1. The work function of caesium (Cs) metal is 2 eV. When monochromatic radiation beam of intensity 60 kWm^{-2} and frequency 6×10^{14}Hz, is falling normally on Cs plate of 6.6 cm^2 in a photocell then
(a) Energy of a photoelectron may be 8×10^{-20} J
(b) Stopping potential is 0.48 V
(c) Saturation current is 16 A
Correct choices are
(1) Only b (2) Only b & c
(3) Only a & b (4) a, b, & c

2. Two statements are given below :
Statement I : Photosensitivity of a metal is high, if its work function is low.
Statement II : Work function for a metal is given by hv_0, where v_o is threshold frequency.
Considering the above, choose the appropriate answer from the options given below :
(1) Both statement I and statement II are correct.
(2) Statement I is correct and statement II is incorrect.
(3) Statement I is incorrect and statement II is correct.
(4) Both statements I and statements II are incorrect.

3. Given below are two statements: One is labelled as **Assertion (A)** and the other is labelled as **Reason (R).**
Assertion (A) : Two photons each of energy 3 eV, can't eject electrons from a surface of work function 5 eV.
Reason (R) : Only a photon of energy greater than work function may emit photoelectron.
In the light of the above statements, choose the most appropriate answer from the options given below:
(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.
(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.
(3) **(A)** is true but **(R)** is false.
(4) **(A)** is false but **(R)** is true.

TG: @Chalnaayaaar

4. On a photosensitive surface of threshold wavelength 5λ, two different monochromatic beams of wavelengths 3λ and λ are incident, one after another, then match the ratio of physical quantities specified in column – I to the ratio values given in column – II

	Column I		Column II
(a)	Maximum KE of photo electrons	(i)	1 : 3
(b)	Speed of incident photons	(ii)	1 : 6
(c)	Momentum of incident photons	(iii)	$1:\sqrt{6}$
(d)	Fastest speeds of photo electrons	(iv)	1 : 1

Choose the correct answer from the option given below :
(1) (a) – iii, (b) – ii, (c) – i, (d) – iv
(2) (a) – ii, (b) – iv, (c) – iii, (d) – i
(3) (a) – ii, (b) – iv, (c) – i, (d) – iii
(4) (a) – i, (b) – ii, (c) – iv, (d) – iii

5. Match the column I with column II –

	Column-I (Radiation)		Column-II (Source)
(A)	X-rays	(P)	Nuclei of atoms and sudden deceleration of high energy free electrons energy free electrons.
(B)	Gamma rays	(Q)	Inner electrons in atoms and sudden deceleration high energy free electrons of high energy free electro high energy free electrons
(C)	Radiowaves	(R)	Oscillating electric circuit
(D)	Infrared	(S)	Outer electrons in atoms and molecules
(E)	Ultraviolet	(T)	Outer electrons in atoms

Options :-
(1) A → P, B → Q, C → T, D → S, E → R
(2) A → Q, B → P, C → R, D → S, E → T
(3) A → P, B → Q, C → S, D → R, E → T
(4) A → Q, B → P, C → S, D → T, E → R

6. Match the column I with column II –

	Column-I (Radiation)		Column-II (Use)
(A)	γ-rays	(P)	Structure of crystal
(B)	X-rays	(Q)	Structure of nuclei
(C)	Microwaves	(R)	Radar and radio broadcasting
(D)	Infrared	(S)	Long distance wireless communication via satellite
(E)	Radio waves	(T)	Structure of molecules

Options :-

(1) A → R, B → P, C → S, D → T, E → Q

(2) A → P, B → Q, C → S, D → T, E → R

(3) A → Q, B → P, C → S, D → T, E → R

(4) A → Q, B → P, C → T, D → S, E → R

7. Match the column I with column II –

	Column-I		Column-II
(A)	Force between a proton and a proton inside nucleus	(P)	Gravitational force
(B)	Force between a proton and a neutron inside nucleus	(Q)	Electrostatic force
(C)	Force on an electron in an atom	(R)	Strong force
(D)	Conservative force	(S)	Weak force

Options :-

(1) A → PQR, B → PR, C → PQ, D → PQ

(2) A → R, B → R, C → Q, D → RS

(3) A → PQR, B → PQR, C → PQ, D → RS

(4) A → PQR, B → P, C → PQ, D → RS

8. Given below are two statements: One is labelled as **Assertion (A)** and the other is labelled as **Reason (R).**

Assertion (A): In Davisson–Germer experiment wavelength associated with the beam decreases with increases of speed of electrons.

Reason (R): Wavelength associated with electron beam in Davission–Germer experiment is given by $\lambda = \frac{h}{\sqrt{2mK}}$

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.

(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.

(3) **(A)** is true but **(R)** is false.

(4) **(A)** is false but **(R)** is true.

9. A proton and an electron both have energy 50 eV.

Statement I: Both have different wavelengths.

Statement II: Wavelength depends on energy, not on mass.

In light of above statement choose the most **appropriate** answer from the options given below:

(1) Both statement I and statement II are correct.

(2) Statement I is correct and statement II is incorrect.

(3) Statement I is incorrect and statement II is correct.

(4) Both statements I and statements II are incorrect.

10. Match the following ratio of De–Broglie wavelengths of a proton and α particle, when both

	List-I		List-II
A	Have same speed	(p)	2 : 1
B	Have same potential difference	(q)	1 : 1
C	Have same kinetic energy.	(r)	4 : 1
D	Have same linear momentum	(s)	$2\sqrt{2}$: 1

	A	B	C	D
1	p	q	r	s
2	r	s	p	q
3	p	r	q	s
4	r	q	s	p

TG: @Chalnaayaaar

11. The wavelength of a photon is twice the de Broglie wavelength of an electron. The speed of the electron is $v_e = \frac{c}{100}$ then,

(a) $\frac{E_e}{E_p} = 10^{-4}$ (b) $\frac{E_e}{E_p} = 10^{-2}$

(c) $\frac{p_e}{m_e c} = 10^{-2}$ (d) $\frac{p_e}{m_e c} = 10^{-4}$

(1) a, c, d (2) b, c

(3) c, d (4) a, b, c

EXERCISE-III (Analytical Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11
Answer	4	1	1	3	2	3	1	1	2	2	2

TG: @Chalnaayaaar